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THE CHANGING U.S.-JAPAN MICROCOMPUTER MARKET

Summary

While Japanese firms pose strong challenges to American competitors in several computer and computer-related fields, the rapidly changing dynamics of the U.S microcomputer market have shown that Japanese success is not inevitable. The market has been so dynamic that Japan's manufacturing expertise is not enough; successful firms combine flexible, low-cost manufacturing with strong research, software, marketing and distribution skills. Although the Japanese microcomputer market has lagged behind its U.S. counterpart for a number of technical and social reasons, it, too, is becoming increasingly dynamic. In terms of both hardware and software, the microcomputer market presents challenges to private firms and governments on both sides of the Pacific.

Introduction

The microelectronic revolution has squeezed the same amount of computational power and storage capacity that took up an entire room in the 1960s into a unit small enough in the 1980s to sit on a desk or even on a person's lap. Microcomputers have greatly increased a user's efficiency in performing such traditional tasks as mechanical engineering and all types of writing, printing, publishing and information management. But they also have brought many previously unmanageable mathematical tasks within easy reach. The role of microcomputers in everyday life can only expand in years to come.

As the computer revolution has evolved, distinctions among small, mid-range and mainframe computers have blurred. The scope of this report is limited

to home computers (units designed to use an ordinary television set to display information and possessing limited computational power), personal computers (stand-alone, portable or stationary units for home or business use), workstations (engineering-oriented machines) and small business systems (systems under $10,000 serving more than one user). Instead of focusing on each of these segments individually, trends affecting the group as a whole will be explored. Unfortunately, official government information is sparse on this topic and, while more plentiful, private data show a fair amount of variation.

A First Glance at the Market

An overview of the aggregate figures for the U.S. and the Japanese microcomputer markets reveals significant differences in size, total value and rate of growth. Until 1981 Apple Computer Inc. machines aimed mainly at home and educational users dominated the American microcomputer market. The August 1981 introduction of a personal computer by International Business Machines Corp., the leader in mainframe computer systems, lit a fire under the market by legitimizing the personal computer as a business tool for corporate America. The microcomputer market jumped from around $3 billion in 1981 to approximately $9 billion by 1984 and about $15 billion by 1986, representing an increase in unit sales from less than a million units in 1981 to 4.6 million in 1984 and about 6 million in 1986. Estimates for 1988 are in the $18 billion range, and projections for the current year cluster around $21 billion with unit volume at the 8 to 10 million level.

As can be inferred from these numbers, growth rates have slowed after making huge leaps in the early 1980s. From the 60 to 80 percent annual rates of expansion between 1981 and 1984, the market has settled down in the 15 to 20 percent range. Similarly, after accounting for the overwhelming majority of microcomputer sales in the early 1980s, personal computer sales have drifted down to about a two-thirds share, while multiuser systems account for about 15 percent and workstations about 10 percent.

Afflicted with several handicaps the Japanese industry has lagged significantly behind its U.S. counterpart (see Table). According to the Ministry of International Trade and Industry, the FY 1981 installed base of small business systems (systems valued at less than Y10 million or $71,400 at Y140=$1.00) was 59,000 units with a value of Y350 billion ($2.5 billion). Personal computers installed had reached about 377,000 units worth about Y137 billion ($979 million) that same year. The market experienced sharp growth in both volume and value terms for the next few years: FY 1984 shipments of small business computers hit 77,600 units worth Y390 billion ($2.8 billion), while domestic shipments of PCs reached 1.2 million, worth approximately Y302 billion ($2.2 billion). After two years of modest growth, these two market segments diverged, with small business systems resuming their strong growth and PC sales creeping upward. According to the latest data, the installed base of small business machines totaled 130,000 units as of March 31, 1988, worth Y1.1 trillion ($8 billion), and the personal computer market had reached about 2.8 million units, valued at Y833 billion ($6 billion). Despite solid growth, the Japanese market remains much smaller than its rival across the Pacific.

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Japanese Shipments of Personal and Small Business Computers

(value in billions of yen and volume in units)

Fiscal Year	Personal			Small Business	
	Value	Domestic (1,000)	Exports (1,000)	Value	Volume
1978	Y5.9	10	0	Y86.1	12,688
1979	15.9	46	10	146.3	20,828
1980	33.7	94	16	229.6	32,831
1981	107.0	227	53	306.7	50,073
1982	231.3	681	79	354.9	65,321
1983	341.6	890	250	382.8	73,280
1984	470.6	1,200	670	390.0	77,633
1985	555.2	1,190	790	428.7	105,365
1986	637.3	1,240	820	466.4	116,681
1987	696.0	1,300	900	510.0	130,000

Source: Ministry of International Trade and Industry

The Japanese Difference

Beyond the obvious point that Japanese makers of small computers got off to a later start than their American competition, there are four reasons why Japan's microcomputer industry has been handicapped:

- Japanese language requirements - While the English language is based on just 26 letters so that keyboards are manageable in size, adequate presentation of Japanese requires at least 7,000 ideographs and two sets of more than 50 phonetic symbols. Developing a keyboard system sufficiently small and easy to learn and operate has been a daunting task. Simply put, early small computers were incapable of handling the Japanese language, severely limiting their use. Within the past two years, however, a new generation of more powerful microcomputers combined with better display technology, larger and faster data storage devices and better programs have made Japanese word processing at least manageable if not easy.

- Communication media - Because no practical Japanese typewriters were developed, communication in Japan has been almost exclusively nontyped. The nearly complete diffusion of facsimile machines in Japanese offices derives from the need to exchange handwritten documents. Not only are Japanese not accustomed to using a keyboard, but they actually prefer handwritten messages because they are more personal. A computer on every desk remains a rare sight in Japan despite all the talk about office automation.

- Executive behavior - Japanese executives are less hands-on oriented than their American counterparts. While an American manager personally might employ computer models and tools in his daily routine, a Japanese manager will delegate such work to a subordinate. Since the boss does not use a computer, others may not be encouraged to do so. Moreover, Japanese executives have a penchant for complex visual presentation of data rather than dry numerical

tables. Until recently the graphics capability of microcomputers was not up to this task. Recent improvements in graphics chips and display technology largely have addressed this requirement.

- Limited software availability - Despite similar origins the software industries in the United States and Japan have diverged significantly. At the beginning of the computer era, hardware manufacturers had to bundle software with their machines to sell them; there were few independent software companies. In the late 1960s, however, major U.S. computer makers began selling the software separately from the machines, opening the door for the development and proliferation of third-party software companies. In Japan this unbundling never occurred. Along with the machine, the seller provides the buyer with a team of software engineers to produce whatever programs are needed. Japanese customers have grown accustomed to receiving software as a bonus when purchasing a computer. Moreover, Japanese users expect custom software to be supplied. While third-party software houses dot the Japanese landscape, they are either "body shops" providing programmers to hardware customers or captive software suppliers to hardware companies. Only in the home entertainment market have strong independent software firms managed to take root.

The U.S.-Japan Experience Contrasted

These unusual characteristics of the Japanese market contrast with the American experience in a number of ways, ranging from computer standards and the firms competing in the marketplace to software availability. Since its entry into the PC market in 1981, IBM has set the industry standards in terms of specifications for a basic operating system and hardware interface. "IBM-compatible" computers quickly dominated the market and have held that position. (About 80 percent of all U.S. personal computers in 1988 fell into this category.) Apple has managed to fight back with its user-friendly Macintosh line of machines and represents a second standard in the U.S. market. The IBM standard has generated a plethora of innovative software, computational enhancements and peripheral equipment that meets the needs of every conceivable user at a reasonable price. Those who have seen the benefits of standardization at the microcomputer level are leading the calls for greater standardization throughout the entire range of computers.

The Japanese market, in contrast, was and remains fragmented. Each manufacturer has its own software and hardware specifications, limiting the market for third-party software and preventing users from linking microcomputers into networks. There have been attempts to establish industry standards. The first, based on a Japanese version of Microsoft Corp.'s BASIC programming language (MSX), foundered on the developer's inability to convince hardware makers to adopt it. The Japanese government was next with its Sigma software project. While Sigma was aimed at creating automated software development tools, a desired byproduct was the adoption of a computer language standard by Japanese hardware makers. Sigma and its successor will be discussed further on, but suffice to say here that it has met with limited success as a standardization effort.

The latest attempt arises from a group of hardware makers attempting to break NEC Corp.'s leading PC market position by offering a hardware/software standard called AX. Based on IBM's PC AT hardware, the new standard uses Microsoft's MS-DOS (the operating system for IBM-compatible machines), which has

been specially modified to handle the Japanese language. AX computers are beginning to hit the shelves, making it premature to judge success or failure. Paralleling these overt trends, most Japanese manufacturers now offer unmodified IBM-compatible computers in the domestic market, creating a market standard by default. The explosion of software and hardware options that took place in the United States, however, may be some time in coming to Japan -- to the detriment of users.

Market compartmentalization also shows striking U.S.-Japan group differences, reflected in the market shares of various firms in Japan. According to a survey by Nihon Keizai Shimbun, Japan's leading economic newspaper, NEC held the dominant position in Japan's PC market in 1988 with a 52.3 percent market share, followed by Fujitsu, Ltd. (13.6 percent), Seiko Epson Corp. (10.1 percent), Toshiba Corp. (9.8 percent) and IBM Japan Ltd. (6.5 percent). Interestingly, foreign and small computer makers are a negligible force in Japan (only about 8 percent) whereas in the United States a few firms -- IBM (with about 25 percent), Apple (9 percent) and Compaq Computer Corp. (7 percent) -- hold relatively large market shares and are followed by a horde of domestic and foreign firms, each with a small slice of the pie.

In Japan's small office computer segment, the 1988 ranking was somewhat different: Fujitsu (with a 26.2 percent share) held a slim lead over NEC (24.9 percent) but was far ahead of the remaining big players -- Toshiba (8.9 percent), IBM Japan (8.2 percent) and Mitsubishi Electric Corp. (8.1 percent). Stronger offerings in this market by foreign companies, such as Digital Equipment Corp., NCR Corp., Unisys Corp. and others, is represented by their 23.7 percent market share.

With regard to specialized word processors, the Japanese market is still more competitive: Sharp Corp. led with a 19.7 percent share, not far ahead of Toshiba (13.3 percent), Matsushita Electric Industrial Co., Ltd. (11.8 percent), NEC (11.6 percent) and Canon Inc. (9.9 percent), leaving 33.7 percent for other makers. The market for dedicated word processors (2,420 million units) actually exceeded that of personal computers (2,100 million units) in 1988, according to the survey.

As might be inferred from the previous discussion about the Japanese software market, custom software plays a much larger role in Japan than in the United States. While off-the-shelf programs for spreadsheet, graphics and word processing functions, among others, are established firmly in the American microcomputer market, customization of these packages is not uncommon in Japan. Independent software houses have to compete for personnel and business against the in-house programmers of deep-pocketed hardware manufacturers. Not surprisingly, this unequal contest has led many independents to close or become subcontractors to hardware firms. A relative dearth of software is a natural consequence of this concentration; about 8,000 programs, for example, have been written for the top-selling NEC line of PCs since their introduction in 1982, while most other makers claim 1,000 or 2,000 programs for their machines. Contrast this with the tens of thousands of programs developed for IBM-compatibles in the United States, Europe and Asia.

American firms became seriously interested in the Japanese market around 1986. Lotus Development Corp., Ashton-Tate Co. and Microsoft had high hopes for

their products, which already dominated the U.S. market. The Japanese bias against packaged software has prevented any runaway successes, but the three have built respectable market positions by modifying their software to meet Japanese preferences.

The Japanese Challenge?

As they built dominant positions in markets for semiconductor memories, electronic components and computer peripherals, Japanese firms gained reputations as juggernauts, gobbling up market share with their manufacturing expertise and willingness to suffer short-term losses. It is no wonder that many Japanese and American analysts predicted that the U.S. microcomputer market was the next course on Japan's plate. This hardware challenge, the predictions read, would be followed up by growing software competitiveness as Japan's programming industry got up to speed. The reality, to date, has been very different. While Japanese firms continue to seek a winning strategy, the Japanese challenge has yet to emerge.

Clone wars - The development that was to provide Japanese firms with an entree to the U.S. hardware market was the domination of a market standard, namely IBM-compatibility. The establishment of a standard supposedly would negate the innovative edge held by American firms and allow the Japanese to apply their manufacturing expertise to a now commodity-like product. In the early 1980s the belief was widespread that Japanese firms would take over the IBM-compatible market.

Japanese manufacturers, however, failed to realize how dominant the IBM standard would become. Japanese makers continued to push their own proprietary or non-IBM compatible gear until they realized they had been left behind. By that time, however, a significant number of non-Japanese sources for components and subassemblies had cropped up. By importing components from Taiwan, South Korea, Mexico and other low-cost nations, even small American companies could assemble high-performance IBM-compatible systems at prices that at least matched, if not beat, those charged by Japanese firms. In 1984 the only Japanese hardware supplier to have a respectable U.S. market share was Epson, at about 4 percent. Two years later Epson was still the only major Japanese maker in the top ranks, but its market share had fallen to 3 percent. In 1988 Epson had faded from the picture to be replaced by NEC, Toshiba, Fujitsu and Matsushita. But even these Japanese giants could place no higher than seventh among the top 15 revenue-earners in U.S. microcomputer sales.

It became clear that efficient manufacturing was not enough. American firms capitalized on better marketing and wider distribution channels to frustrate the Japanese on U.S. turf. Standardization also took away the edge Japanese firms had gained for better quality. Tandy Corp.'s line of IBM compatibles offered through its vast Radio Shack network of stores initially was discounted by industry analysts. By emphasizing low prices and comparable performance, however, Tandy has carved out a solid market position.

Even though the IBM standard has continued to dominate, it has evolved to keep pace with technological progress. Here, too, the Japanese have proved less than nimble. Usually known for their ability to leapfrog competitors in terms of technology, Japanese firms proved no match for IBM or aggressive clone makers like Compaq. With key components, such as microprocessors and basic

operating programs, out of their control, Japanese firms were unwilling to leap ahead for fear of making a mistake, being unable to influence the market and becoming isolated.

A shortage of basic memory chips in the 1986-88 period opened a window for vertically integrated Japanese manufacturers. As prices for DRAMs (dynamic random-access memories) shot up in the wake of the July 1986 U.S.-Japan semiconductor accord and a recovery in worldwide demand, U.S. computer makers were forced to hike price tags and/or cut back on output. Japanese firms that produced both DRAMs and PCs used the advantage of their vertically integrated structure to aggressively pursue price-conscious U.S. buyers.

The situation was reversed in April 1987 when President Reagan ordered 100 percent penalty tariffs on imports of Japanese 16-bit and 32-bit computers because of Tokyo's failure to fully enforce the bilateral semiconductor agreement. The sanctions, which still are in effect, have hobbled Japanese efforts to respond to the latest generation of competitors' offerings. In an effort to get around the sanctions, some Japanese makers have set up local production facilities or signed contracts with domestic manufacturers to produce computers for U.S. sale under Japanese nameplates.

On Your Lap, Get Set, Go - The rapidly growing market for battery-powered laptop computers is supposed to be even more suited to the strengths of Japanese firms than the IBM-compatible market was. Japanese semiconductor makers consistently have emphasized reducing the power consumption of their products. Combined with Japanese technological leads in battery technology, computer peripherals and display technology, the laptop market was seen as Japan's oyster. And, indeed, it was the early 1987 introduction by Japanese companies of more legible, high-contrast liquid crystal display screens that gave a boost to the market and put them at the top. Sales of laptops in 1987 jumped to about 500,000 units worldwide from about 175,000 units just two years before. Estimates for 1988 (700,000 units) were very rosy, and the projections for this year (over 1 million) are even better.

After taking a large lead in market share, however, Japanese firms now face able competition. Both Zenith Data Systems Corp. and Tandy initially bought their products from Japanese competitors. While Tandy has maintained ties with Japanese producers, Zenith now makes its own laptops in the United States. Zenith's innovative display technology and aggressive pricing brought it into a neck-and-neck battle for first place with Toshiba in 1988 laptop sales. NEC, with its 1988 introduction of a laptop about one-half the size and one-third the weight of previous models, is making a strong bid for market share. The market is quite fluid as major U.S. makers, such as IBM and Apple, have ignored the market or stumbled with unexciting products.

A host of American start-ups is bringing to market even smaller models. Poqet Computer Corp. of Sunnyvale, California hopes to introduce by August an IBM PC XT-compatible unit measuring 8.7 inches by 3.9 inches by 0.75 inches and weighing about 1 pound. Toshiba has introduced a notebook-sized unit that is expected to be matched by Zenith and other competitors. The point is that American firms have taken a page from Japanese manufacturers by staying ahead technologically while paying attention to production efficiency. What looked like a made-for-Japan market has turned out to be anything but that.

A Tough CASE - While microcomputer hardware roughly has doubled its available power every two years, computer software has not been able to keep pace. Without programs that take advantage of its greater capabilities, advanced hardware is pointless. The majority of today's computer programs still are produced a line at a time by human writers. When programs were relatively small and simple, one or a few people could produce a working product within a reasonable time. Current microcomputer users, however, demand programs of such complexity and performance that programming the old way becomes impossible. Long delays in bringing programs to market and error-laden programs are unfortunate realities today. Programmers are pursuing several solutions to counter the problems of complexity and reliability. Libraries of tested, error-free program modules are being assembled. By linking together these easily understandable, proven building blocks, groups of programmers can assemble workable programs in less time.

To further aid this process computers themselves are being called upon. Computer-aided software engineering or CASE is a rapidly growing field in the United States. In Japan, on the other hand, both the modular approach to programs and CASE have been a goal for some time. The modular orientation appeals to Japanese firms because it fits naturally with their group approach to software. Modular languages allow programmers to divide up their task into manageable pieces with a reasonable assurance that the whole thing will work when the modules are hooked together. CASE, on the other hand, responds to the lack of programmers in Japan. The Ministry of International Trade and Industry consistently has projected that there will be a shortage of programmers in Japan through the year 2000. By developing computerized programming techniques, this shortage can be negated.

MITI's Sigma project was the first government-backed CASE project. By the end of FY 1989, Tokyo will have spent about Y25 billion ($179 million) on the five-year project to develop CASE tools for programmers. Interestingly, Sigma employs a version of American Telephone and Telegraph Co.'s Unix operating system that allows compatibility with a wide range of hardware. Sigma workstations and a central database of tools and guidelines have been developed and are being tested. Their real test, however, will be whether Japanese companies pay for and use the results of Sigma.

Taking the next step MITI launched the Super Sigma project this fiscal year. With an initial funding of Y100 million ($714,000), the goals of the project are to develop programs that will write other programs more quickly and better than humans and to develop a programming language simple enough for non-programmers to use. Applying artificial intelligence to programming is a daunting task that few American companies are attempting. Instead, Americans are trying to develop CASE tools to support and complement their already strong software capabilities. Programs that churn out a rough working program or ones that do much of the tedious writing are favored goals. Programs that can find errors also are a high priority. It is far too early to tell if the American or the Japanese approach will succeed. The efforts do underscore the importance of software, however.

A TRON to nowhere? - As part of its catalog of foreign trade barriers compiled under the 1988 Omnibus Trade and Competitiveness Act, the Office of the U.S. Trade Representative expressed concern about Japan's government-industry project to develop a 32-bit microprocessor architecture. The sudden

spotlight on the TRON project highlighted Japan's attempt to counter its weakness in microprocessors and in operating system software for microcomputers.

The TRON project grew out of a [illegible]3 report by the operating systems working group of the microcomputer technology committee of the Japan Electronic Industry Development Association, a quasi-governmental organization. Reflecting the current and the future needs of Japanese microcomputer users, the Real-Time Operating-system Nucleus project was launched in June 1984. Located at Tokyo University, the project brought together academics, seven computer makers (Fujitsu, Hitachi, Ltd., Matsushita Electric, Mitsubishi Electric, NEC, Oki Electric Industry Co., Ltd. and Toshiba) and the then government-owned Nippon Telegraph and Telephone Public Corp. In the words of TRON director Ken Sakamura, an associate professor of information science at the university, "The TRON project has a very broad agenda. Its tangible products will be basic operating system software and a new dedicated 32-bit microprocessor. But we also want to develop a whole new computer culture, including new support systems and user environments and a standard education system." According to the professor, TRON has four guidelines:

1. TRON will be based on new hardware technology suitable to the 1990s -- a new architecture not compatible with past systems, implemented on a new microprocessor.

2. Both the operating system and all applications arising from it must operate in real time.

3. Design rules for programs will be separate from applications, creating an open system for all to use.

4. Ease of learning and use are key concepts. While hardware may differ slightly, all TRON programs must have a similar user interface.

In 1986 the project became more focused with the establishment of the TRON Association, a semiprivate organization deriving its funds in equal shares from MITI and the private sector. While the core consists of the seven computer companies plus NTT, membership has been open to anyone for a nominal fee. The project was divided up quickly into several software and hardware components: ITRON or industrial TRON for use in automated manufacturing; business TRON or BTRON for personal computers and workstations; central TRON aimed at linking ITRON and BTRON through larger computer systems; macro TRON to link all TRON units into a network; and STRON for supercomputer applications. In addition to the basic TRON microprocessor, hardware tasks include developing TRON-based graphics chips and developing better keyboards and other input devices.

By 1986 NEC had developed an ITRON microprocessor, while Hitachi, Mitsubishi Electric and Fujitsu had designed ITRON programs for American microprocessors (Motorola Inc.'s 68000, National Semiconductor Corp.'s NS 32000 and Intel Corp.'s 80286, respectively). Hitachi and Fujitsu followed up by unveiling a high-performance BTRON microprocessor in January 1988. That same month NTT, which is responsible for developing CTRON by combining it with the communications link formerly named macro TRON, specified that future generations of telephone switching equipment must use TRON. In mid-1988 the Center for Educational Computing, a government-private organization, made a preliminary recommendation that Matsushita's 16-bit computer based on BTRON architecture be

adopted as the standard computer for educational use in Japan. These last two announcements set off warning bells in Washington.

During talks with their Japanese counterparts in September 1988 senior American trade officials charged that the educational computer center's selection of Matsushita locked out all foreign competitors. Apple, particularly, was concerned over losing a chance at Japan's huge education market. NTT's CTRON requirement also drew U.S. fire. Because American analysts feel that TRON offers no advantages over existing operating systems, such as AT&T's Unix, IBM's OS/2 or Microsoft's Windows, the project has gained more sinister overtones in some eyes. The real purpose of TRON, they fear, is to end American dominance of the high-performance microprocessor market.

Japanese officials are perplexed by the American position. Not only is the TRON Association open to all interested parties, but IBM Japan and 13 other foreign firms are part of the group. The Japanese subsidiaries of IBM, Unisys and Intel also are members of the Center for Educational Computing and voted in favor of adopting TRON for educational computers. TRON was designed specifically to be an open system, the project head argues, adding that if American firms are not interested in getting in on the ground level, they should not complain later. NTT has responded to criticism both by pointing out that no standards for the next generation of switching equipment have been set and by welcoming foreign participation in developing TRON-based gear. Nevertheless, in the face of USTR's listing of TRON in its catalog of Japanese barriers to U.S. exports, CEC has backed down and probably will endorse Microsoft's MS-DOS as the standard operating system for educational computers. This will not, however, put an end to Japan's search for an alternative to dependence on American microprocessors and operating systems.

Outlook

The outlook for microcomputers in Japan and the United States is bright but filled with opportunities for conflict as well as cooperation. Better hardware and software will invigorate the Japanese personal computer market, and analysts are predicting annual growth of 20 to 30 percent for the next few years. (These same analysts have been overly optimistic in the past, however.) The American market, meanwhile, will remain dynamic as the industry grapples with important issues.

- Software standards - Ironically, the desire to achieve a universal hardware and software standard is a major topic in the United States. Groups have formed around MS-DOS, OS/2 and Unix in regard to software. Microprocessor makers, particularly in the reduced-instruction set computing (RISC) segment, are battling fiercely to develop loyalty for what remain incompatible products. The results of these contests will determine the landscape of the market, if only for a few years.

- Laptop market - While the current battle among laptop makers is fierce, it may look like little more than a skirmish compared to future battles with makers of desktop machines. If laptop makers can offer a product with all the performance of a desktop model at a competitive price, users may be willing to trade their fixed computers for something more mobile. The planned entry of Apple and the persistent efforts of IBM and Compaq to develop viable portable models not only will enliven the laptop market but hasten the face-off with the desktop market.

• Group software and networking software - Software designed to allow microcomputers to exchange files and other information back and forth is well-developed in the United States and becoming accepted in Japan. The next generation of programs is targeted at working groups, allowing several microcomputers to work on the same document at the same time or to assemble a final project from separate pieces easily and effectively. Students of Japan will recognize immediately that this group-oriented approach is ingrained in almost every aspect of Japanese life, including corporate operations. Group software is ideally suited to Japan, creating an opportunity for American software companies and attracting strong Japanese competition.

If one axiom is applicable to the microcomputer market, then it is that success and failure do not play favorites. Giant companies, such as IBM, AT&T, NEC and Fujitsu, as well as small start-ups have equal potential to stumble or to hit a home run. The U.S.-Japan microcomputer market will continue to surprise and confound both companies and governments alike.

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The views expressed in this report are those of the author and do not necessarily represent those of the Japan Economic Institute.